

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
6 May 2004 (06.05.2004)

PCT

(10) International Publication Number  
**WO 2004/037460 A1**

(51) International Patent Classification<sup>7</sup>: **B21D 24/14**,  
22/21

(21) International Application Number:  
PCT/NL2003/000720

(22) International Filing Date: 23 October 2003 (23.10.2003)

(25) Filing Language: Dutch

(26) Publication Language: English

(30) Priority Data:  
1021738 24 October 2002 (24.10.2002) NL

(71) Applicant (for all designated States except US): NED-  
ERLANDSE ORGANISATIE VOOR TOEGEPAST-  
NATUURWE TENSCHAPPELIJK ONDERZOEK  
TNO [NL/NL]; Schoemakerstraat 97, NL-2628 VK Delft  
(NL).

(72) Inventors; and

(75) Inventors/Applicants (for US only): BOLT, Pieter, Jan  
[NL/NL]; Basilicumhof 31, NL-1115 NL Duivendrecht  
(NL). GUNNINK, Jan, Willem [NL/NL]; Broekmolen-  
weg 1, NL-2289 BE Rijswijk (NL). VAN LEEUWEN,

Jacobus, Franciscus, Cosmas [NL/NL]; Marconilaan  
129, NL-5612 HR Eindhoven (NL). DE NOOY, Margriet  
[NL/NL]; Windevlindestraat 92, NL-5641 DR Eindhoven  
(NL). WERKHOVEN, Robert-Jan [NL/NL]; Bart de  
Ligtstraat 12, NL-5671 DH Nuenen (NL).

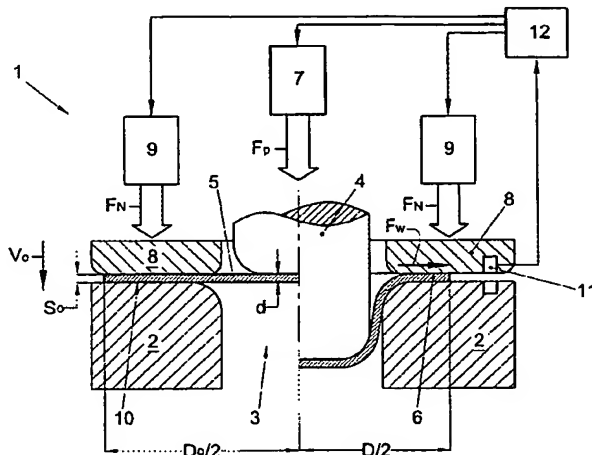
(74) Agent: PRINS, A.W.; Nieuwe Parklaan 97, NL-2587 BN  
Den Haag (NL).

(81) Designated States (national): AE, AG, AL, AM, AT (util-  
ity model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA,  
CH, CN, CO, CR, CU, CZ (utility model), CZ, DE (util-  
ity model), DE, DK (utility model), DK, DM, DZ, EC, EE  
(utility model), EE, EG, ES, FI (utility model), FI, GB, GD,  
GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR,  
KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN,  
MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU,  
SC, SD, SE, SG, SK (utility model), SK, SL, SY, TJ, TM,  
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,  
ZW.

(84) Designated States (regional): ARIPO patent (GH, GM,  
KE, LS, MW, MZ, SD, SI, SZ, TZ, UG, ZM, ZW),  
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),  
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,

[Continued on next page]

(54) Title: METHOD AND APPARATUS FOR REDUCING WRINKLE FORMATION IN DEEP DRAWING



(57) Abstract: A method and apparatus for deep drawing a product from a blank(5), in which, during deep drawing, the blank(5) is held near its edge by a downholder (8) against a die ring cooperating with the downholder (8), thereby preventing, at least reducing wrinkle formation in the blank, by adjusting, at the beginning of deep drawing, the downholder (8) such that a downholder (8) force exerted by the downholder (8) on the edge of the blank is relatively small, and by controlling, during the further course of the process, the downholder (8) on the basis of a predetermined thickness trend of the mentioned edge during deep drawing and/or a trend or critical value derived from this thickness trend.